

Conservation of Energy

6-5 The student will demonstrate an understanding of the law of conservation of energy and the properties of energy and work. (Physical Science)

6-5.2 Explain how energy can be transformed from one form to another (including the two types of mechanical energy, potential and kinetic, as well as chemical and electrical energy) in accordance with the law of conservation of energy.

Taxonomy level: 2.7-B Understand Conceptual Knowledge

Previous/Future knowledge: In 4th grade (4-5.5), students explained how electricity could be transformed into other forms of energy (including light, heat, and sound). Students will further develop these concepts in high school Physical Science (PS-6.1).

It is essential for students to know that the *Law of Conservation of Energy* states that energy cannot be created or destroyed. It may be transformed from one form into another, but the total amount of energy never changes. Energy can be changed from one form to another as follows:

Mechanical energy transformations

The mechanical energy that an object has may be kinetic energy or potential energy or some combination of the two. Energy transformations can occur between the two types of mechanical energy.

Examples of potential ↔ kinetic mechanical transformations might include:

- When water is behind a dam, it has potential energy. The potential energy of the water changes to kinetic energy in the movement of the water as it flows over the dam.
- When a rubber band is stretched, kinetic energy is transformed into potential energy.
- When a stretched rubber band is released its potential energy is transformed into kinetic energy as the rubber band moves.
- When a book is lifted to a shelf, kinetic energy is transformed into potential energy.
- If the book falls off the shelf the potential energy is transformed to kinetic energy.

It is essential for students to understand situations when potential energy is greater and when kinetic energy is greater.

Mechanical energy transformations may involve other kinds of energy. Examples might include:

- When the book in the example above hits the floor the kinetic energy is transformed into other forms of energy such as sound and heat.
- The water that runs over the dam might be used to power an electric generator and thus the mechanical energy associated with the water can be transformed into electrical energy.
- The water was behind the dam because the energy from the sun evaporated water and deposited it at a higher elevation so that it could flow down hill thus solar energy was transformed to potential mechanical energy.

Transformations may occur between any of the various types of energy but the energy itself is always around in some form. It is never lost. Examples might include:

- Green plants transform the Sun's energy into food which is a form of stored chemical energy.
- Animals use chemical energy from food to move. The chemical energy in the food is transformed to mechanical energy.

Conservation of Energy

6-5 The student will demonstrate an understanding of the law of conservation of energy and the properties of energy and work. (Physical Science)

- Carbon-based fuels are all derived from the bodies of plants and/or animals. When carbon-based fuels (wood, natural gas, petroleum, or coal) are burned, the chemical energy which is transformed to heat energy.
- The heat energy from fuels can be transformed to electrical energy at a power plant.
- In an electric circuit the electrical energy can be transformed into many different types of energy such as mechanical, sound, light, and heat. (See Indicator 6-5.4)
- All of the energy from the electric circuit eventually changes to another form, much of it heat energy. The energy from all of these transformations still exists. The total amount of energy is conserved.

It is not essential for students to know the formulas for potential energy and kinetic energy. Students do not need to know the chemical equation for photosynthesis.

Assessment Guidelines:

The objective of this indicator is to *explain* how energy can be transformed from one form to another in accordance to the law of conservation of energy; therefore, the primary focus of assessment should be to construct a cause-and-effect model of how energy transformations follow the Law of Conservation of Energy. However, appropriate assessments should require students to; *interpret* diagrams or illustrations related to energy transformations; or *summarize* energy transformations and how the Law of Conservation of Energy applies.